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The role, responsibilities and status of the clinical medical physicist in AFOMP

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Abstract

This document is the first of a series of policy statements being issued by the Asia-Oceania Federation of Organizations for Medical Physics (AFOMP). The document was developed by the AFOMP Professional Development Committee (PDC) and was endorsed for official release by AFOMP Council in 2006. The main purpose of the document was to give guidance to AFOMP member organizations on the role and responsibilities of clinical medical physicists. A definition of clinical medical physicist has also been provided. This document discusses the following topics: professional aspects of education and training; responsibilities of the clinical medical physicist; status and organization of the clinical medical physics service and the need for clinical medical physics service.

Key words clinical medical physicist, medical physics, role and responsibilities, education, training

Introduction

The Asia-Oceania Federation of Organizations for Medical Physics (AFOMP) was founded during the World Congress on Medical Physics and Biomedical Engineering in Chicago in July 2000.

The current membership includes seventeen national organizations which together represent about 3000 medical physicists.

AFOMP was officially inaugurated and admitted by IOMP as one of its regional organizations in 2000. The formation of AFOMP aims to provide a solid platform for closer collaboration and mutual support amongst the medical physics organizations in the Asia and Oceania regions for the primary purpose of promoting the advancement of medical physics and related scientific activities and the development of the standard of practice and professional status of the medical physicists. To help achieving these goals and objectives, AFOMP has established three committees, namely Professional Development Committee (PDC), Education & Training Committee (ETC) and Science Committee (SC) to work on a number of important tasks. Among them are drafting of a set of policy statements which give recommendations and guidelines on issues such as the definitions on the role and responsibility of medical physicists, their professional and quality standards, and the standard and structure of education and training of medical physicists. This policy statement, which is the first of a series of documents being prepared by the joint efforts of the Committees, outlines the official views of AFOMP on definition of the roles and responsibility of clinical medical physicists. It aims to serve as a guideline or reference document for AFOMP national organizations.

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Medical physics - past, present and future

In the past the physicists' contribution to the initial progress of some applications of physics in medical science was made from outside direct clinical involvement. During the last 20 years however the situation has developed where physicists are main collaborators with the clinicians in almost all fields of medicine, especially in the radiological field. Medical electronics and clinical engineering or biomedical engineering have commonly developed from the activities of physicists.

In some countries these are today regarded as part of the integrated medical physics service, while in other countries as separate from it, although closely related. In the future, physics will be of even more importance both in clinical medicine and in medical science. Medicine can be expected to become more scientific and quantitative. Scientific data will be of more significance in the diagnosis and treatment of diseases. Medical physics will play an increasingly important part in this development. High standards in medical physics services must be maintained and sufficient resources directed towards this.

In this policy statement we have used the example from the long established speciality of radiation physics (radiation oncology, diagnostic radiology and nuclear medicine). However, the more recently developed fields of medical electronics, medical informatics, clinical engineering etc. should not be underestimated.

Definition of the clinical medical physicist

AFOMP has discussed the definition of a Clinical Medical Physicist and has come to a consensus on the following:

"A qualified Clinical Medical Physicist is a person who is qualified with a master university degree or equivalent in physical science or engineering science and working in alliance with medical staff in hospitals, universities or research institutes. In addition to his/her university degree or equivalent, a Clinical Medical Physicist shall have specialist training in the concepts and techniques of applying physics in medicine including training in the medical application of both ionizing and non-ionizing radiation. This person must have a thorough knowledge in one or more sub-fields of medical physics, including radiotherapy physics, imaging physics, nuclear medicine physics and radiation protection."

These recommendations are intended to be applied only to medical physicists who are involved in clinical work or research activities related to patient care. These physicists have or might have an influence on the diagnosis and/or treatment and safety of patients, or their decisions might have consequences for the quality of diagnostic, treatment and safety procedures in hospital care.

Professional aspects of education and training

Education and training of clinical medical physicists is fundamental in defining role, responsibilities and status. The development of medical physics in each country depends to a large extent on the establishment and standard of education. In general it can be said that medical physics is most advanced in countries where there exists a more formal organization for education and training of clinical medical physicists. It is therefore important that senior academic positions of medical physics at universities should be established in every country. They should have dual responsibilities in the faculty of medicine and hospitals.

The education and training programme for clinical medical physicists could be divided into three phases. The first phase is to bring the physicist up to a basic academic standard during an initial period of training at the university in physics, mathematics and other relevant topics in physical science. The second phase is to introduce medical physics in the education and the third phase is in-service professional training in hospitals in one or more of sub-fields of medical physics. After finishing, the physicist can be recognized as a qualified clinical medical physicist. AFOMP recommends that each clinical medical physicist, upon completion of his/her education and professional training programme be assessed for competency to practice independently in one or more sub-fields of medical physics through a certification scheme conducted by a professional body such as the national organization. A certified medical physicist is recognized by AFOMP as a qualified clinical medical physicist. It should also be possible to reach a senior level by further education, training and experience, and to get a higher academic degree, i.e. Ph.D. or equivalent in medical physics. The Committee will not in these recommendations go into details about education and training but will only give a view of the levels.

First stage: An entrant to medical physics training should have at least a Bachelor degree in physics, engineering or equivalent.

Second stage: Education in medical physics should follow as a formal postgraduate course of lectures, seminars, tutorial and practical work. A minimum of one to two years is required. It should be possible from the beginning at this stage to concentrate on, for instance, medical radiation physics but the courses should in such cases also include other aspects of physics applied to medicine. The second stage can run simultaneously with the third stage.

Third stage: In-service professional training should be done under the supervision of a qualified clinical medical physicist. It is an advantage if during in-service training the physicist gets opportunities to do individual work on projects. The length of the in-service training period should be two years or longer.

Every country should organize formal post-graduate programs in medical physics and create opportunities to provide in-service training, ideally in the form of a residency programme for those who wish to make a career in clinical medical physics. It should be possible for the medical physicist to attend additional courses which give opportunities for obtaining deeper understanding and knowledge in special branches of medical physics. This is

necessary as even in the field of medical radiation physics a high degree of specialization among clinical medical physicists in different types of applications of radiation physics to medicine. A further training to the senior level should be arranged and the universities or some of them should have the capacity to arrange training leading to a Ph.D. or equivalent in medical physics. However, it should be recognized that academic training of this nature cannot take the place of in-service training which, ideally, should be organized through properly constituted national training schemes.

Responsibilities of the clinical medical physicist

In countries where the clinical medical physics service is well developed it plays an essential part in medical care and health services. AFOMP recommends that the responsibility of the clinical medical physicist should be recognized by the national health authorities in every member country. AFOMP considers that national recognition of clinical medical physicists, perhaps by a structure comparable to that used for medical doctors, might be appropriate in establishing a base for competence and responsibility. The main functions and responsibilities of the clinical medical physicist can be summarized as[1,2]:

1. Management, scientific responsibility, advice and direction
2. Design of installations, equipment procurement, acceptance testing and commissioning
3. Radiation dosimetry
4. Perform or supervise others to perform, radiotherapy, diagnostic radiology, nuclear medicine and imaging procedures
5. Development and commissioning of new treatment and diagnostic techniques, procedures and modalities
6. Quality assurance, safety and supervise the maintenance of equipment
7. Radiation safety and protection
8. Medical informatics, computing and networking
9. Teaching and training
10. Research and development

Some key role and responsibilities of medical physicists are listed in the Appendix[5]. The exact role and responsibilities of medical physicists may vary among countries, depending on socio-economic background, training, service models, national health and regulatory policies. Furthermore, the tasks of medical physicists evolve with time as new medical technologies and methodologies are introduced into the hospitals. For this reason, the list should be subject to regular review and update.

Status and organization of the clinical medical physics service

The status of clinical medical physicists and the clinical medical physics service varies largely throughout Asia-Oceania: This depends on several factors but in general it is related to the existence and standard of the education and training in medical physics and to the standard of service provided. In some countries this standard is high and the ultimate goal in other countries to reach the same level.

The organization of the clinical medical service also varies widely. In countries where the clinical medical physics service is of the highest standard the service is organized with independent departments of clinical medical physics. That means that the head of the department is a clinical medical physicist at senior level responsible for the clinical medical physics service within a hospital or within a region. Clinical involvement will be broad and flexible with a strong supporting organization. It is of importance that the clinical medical physics service is not directed only to a few particular hospitals, for example, university hospitals. Other hospitals in a region should also achieve the same standard of service, which means that the departments of clinical medical physics should serve a whole region or a part of a region.

It is of great importance that the profession of clinical medical physics has a recognized high status, that good working conditions and facilities are provided and that the organization of the medical physics service is attractive for clinical medical physicists. A good career structure for clinical medical physicists is of importance.

The need for clinical medical physics service

A survey of the number of clinical medical physicists per million populations in member countries shows a wide variation, ranging from 0.2 to 12.8[3]. Only 7 out of the 17 member countries are in Health Care Level I. Figures can be used in comparisons between countries only if they have about the same standard of medical care. Countries which do not have this standard but strive to reach it, should in their planning, take into account the medical physics service needed to obtain this standard.

The number of clinical medical physicists needed in diagnostic radiology, radiotherapy, nuclear medicine and radiation protection is correlated to the number of institutions and the level of equipment such as radiotherapy units. As a reasonable approach, countries at an early stage of development of medical physics are in fact developing medical radiation physics first as this is still the largest single part of the medical physics service. AFOMP considers this strategy suitable and that it will form a basis for further development of physics service in other applications of physics in medical care. The number of clinical medical physicists and supporting staff must be adequate to meet the high standards of service required. AFOMP considers that for radiotherapy physics services, the manning scale as recommended by the current edition of IAEA TECDOC 1040[4] a minimum requirement. AFOMP considers that a minimum of one clinical medical physicist is required for each diagnostic radiology department and a minimum of one clinical medical physicist is required for each nuclear medicine department. National organizations should be responsible to advise

health authorities on such provision based on AFOMP recommendation.

Appendix

Role and responsibilities of medical physicists

The key role and responsibilities of medical physicists include the following[5]:

Safety

1. Establishing and implementing programs to ensure the quality, safety, correct maintenance, and effective use of therapeutic and diagnostic medical equipment.
2. Supervising the management and custody of radiation sources.
3. Formulating radiation protection guides and procedures specific to hospital environment and other professional groups and organizations; conducting specialized measurements and producing protocols to optimize radiation exposure of patients, and minimize radiation dose to staff and the general public.
4. Performing risk assessment, radiation protection design, shielding calculation on radiological installations.
5. Participating in and contributing to the development and implementation of national and international standards, laws and regulations relating to patient safety, particularly to radiation and radioactive materials.
6. Supervising and managing radiation workers and other health professional workers as relevant.

Clinical

7. Calibrating radiation sources, external and internal, and measuring radiation in therapeutic and diagnostic radiological procedures to ensure the correct and accurate delivery of radiation dose to a patient.
8. Optimizing the physical aspects of diagnostic and therapeutic procedures.
9. Implementing, advising, and supervising the delivery of new clinical procedures.
10. Developing, implementing, and supervising a quality assurance program for equipment and procedures involving the delivery of ionizing and non-ionizing radiation in diagnostic and therapeutic procedures.
11. Participating at patient discussion conferences and advising healthcare personnel with regard to issues involving delivery of radiation dose.
12. Performing or supervising the performance of others in radiation treatment planning and dose calculation, and design and fabrication of treatment aids and treatment-beam modifiers for individual patient treatments.
13. Advising and consulting with physicians on the physical and radiobiological aspects of patient treatments.
14. Advising and consulting with physicians on the development of safe and effective techniques and procedures in the application of ionizing and non-ionizing radiation in diagnosis and therapy of human diseases.
15. Performing or supervising others to perform acquisition, analysis and interpretation of clinical image and/or data for the purpose of studying/diagnosis/treatment of human disorders and illnesses.
16. Providing consultation and support on medical informatics and computer network management.

Management and planning

17. Conducting or providing consultation/support on the conduct of specialised examinations of patients, improving patient care and clinical services, developing innovative imaging and other diagnostic procedures for specific medical applications.
18. Planning, directing, conducting, and participating in supporting programs and remedial procedures to ensure effective and safe use of ionizing and non-ionizing radiation in patients.
19. Performing or providing consultation on planning, development and implementation of new clinical services and facilities.
20. Providing consultation on strategic planning of medical equipment technology; preparing specification for equipment acquisition; performing or supervising testing, commissioning, and management of medical equipment.

Research and development

21. Conducting research and development of new technology, methodology and procedure in radiation therapy, diagnostic radiology, nuclear medicine and other clinical services.
22. Conducting research into human disorders, illnesses and disabilities; investigating biophysical techniques associated with any branch of medicine.
23. Supporting the physical aspects of clinical trials and research involving the delivery of ionizing and non-ionizing radiation to patients for diagnostic and therapeutic purposes.
24. Developing novel instrumentation and physiological measurement techniques, mathematical analysis and applications of computers in medicine in response to clinical need for patients.
25. Preparing, publishing and presenting scientific papers and reports.

Teaching

26. Teaching the principles of medical physics and radiation safety to physicians, residents, graduate students, medical students, technologists, and other health care professionals.
27. Mentoring trainees and junior staff in medical physics.

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